

Ovipositing Odonata: dragonflies and damselflies at a flood-retarding basin

Introduction

The afternoon of 9 February 2011 was pleasantly warm, calm and sunny, so I decided to go for a walk around the flood-retarding basin in the north-east section of Monash University's Clayton campus, in suburban Melbourne. The basin, some 200 m long and approximately 80 m across at its widest point, is always interesting to visit, and this time I was about to see something special.

Egg-laying 'Emperors'

Just above the surface of the water, a profusion of rapidly beating translucent wings shimmered in the sunlight: hundreds of pairs of Australian Emperor dragonflies *Hemianax papuensis* (Aeschnidae) were engaged in the process of laying their eggs in the eelweed Giant Val *Vallisneria gigantea*. Rings of tiny ripples encircled the females' abdomens where they entered the water (Fig. 1). But, although intent on producing the next generation, these insects could not devote their attention exclusively to this activity, because peckish Pacific Black Ducks *Anas superciliosa* swam amongst them, snapping up any that were too slow to escape (Fig. 2).

In Australian Emperor dragonflies—and some other dragonfly and damselfly species—the male guards the female while she lays her eggs, so the pairs remain attached in 'tandem position' after mating (Fig. 1). Sites are selected where the female can lay her eggs directly into plant tissue (Brishane insects web site; Ian Endersby pers. comm. 14 March 2011). If some vegetation protrudes above the water at the chosen site, the male will use it for support (Theischinger and Hawking 2006 photo p. 15; pers. obs.). If the female stops beating her wings for any reason—for instance if she sinks low in the water—the male beats his faster to compensate (pers. obs.).

Reproduction and life cycle

Dragonflies and damselflies have a unique method of reproduction. The male has two sets of genitalia, the first on the ninth abdominal segment and the second on the second ab-



Fig. 1. Australian Emperors



Fig. 2. Pacific Black Duck eating Australian Emperor

dominal segment. Before copulation, the male, which is able to bend his abdomen so that the two sets of genitalia touch, transfers sperm to his secondary genitalia. He clasps the female on the occiput (back of the head—dragonflies) or prothorax (neck—damselflies), first with his legs then with the appendages on the tip of his abdomen. Then the female curls her abdomen so that her genitalia contact the male's secondary genitalia, and sperm is transferred to

her storage sacs. This mating configuration is known as the 'wheel position'. Dragonflies and damselflies can fly in this position as well as in tandem (Zborowski and Storey 2003).

The female uses the stored sperm to fertilise her eggs as she lays them. Female dragonflies lay large numbers of eggs—from 400 to 2000, depending on the species. Those that lay in the water produce more eggs than those that lay in plant tissue or mud (Theischinger and Hawking 2006). All damselfly species lay their eggs in plant tissue. Generally the eggs are not all laid at once, but in batches (Ian Endersby pers. comm. 19 February 2011).

After a larva emerges from an egg it goes through several development stages (instars), feeding on aquatic invertebrates such as the larvae of other insects. The final instar moves out of the water on to a plant, log or rock and the adult emerges from its larval skin. This development process can take from two months to 10 years, depending on the species and the water temperature (Brisbane insects web site). After the adult emerges, it leaves the water for the following one to four weeks, during which time its colour develops and it reaches sexual maturity. Depending on the species, mature adults either return to their natal water body or

visit a number of water bodies. Males select a territory where they wait for females to arrive (Theischinger and Hawking 2006). The adults live for about seven to ten weeks (Brisbane insects web site).

Male dragonflies can be very aggressive. They attack each other when defending their territories, sometimes damaging their wings in the process. In some species the males will even attack females that are laying eggs. A male can remove sperm from a female that has previously mated with another male, replacing it with his own (Brisbane insects web site; Ian Endersby pers. comm. 19 February 2011). I noticed some single Australian Emperors attack pairs while the females were laying eggs, but these challenges appeared to be unsuccessful.

More dragonflies

The spectacle I witnessed on 9 February inspired me to visit the basin frequently during February and March. Although I saw no repeat, I was delighted to find three more species of dragonfly: Blue Skimmer *Orthetrum caledonicum* (Libellulidae) (Figs. 3, 4, 5), Wandering Percher *Diplacodes bipunctata* (Libellulidae) (Fig. 6) and Tau Emerald *Hemicordulia tau* (Hemicorduliae) (Fig. 7).



Fig. 3. Male Blue Skimmer guarding territory



Fig. 4. Blue Skimmers mating

Fig. 5. Male Blue Skimmer on bird dung



Fig. 6. Male Wandering Percher guarding territory



Fig. 7. Tau Emerald

In the Tau Emerald, as in the Australian Emperor, mature adults of both sexes are similar in colour, whereas in the Blue Skimmer and Wandering Percher they are different colours—but old female Blue Skimmers develop the powdery blue colour (Brisbane insects web site), and well developed mature male Wandering Perchers can be yellow instead of red (Ian Endersby pers. comm. 18 February 2011). In mature Tau Emeralds the black colour on the upper abdomen shines emerald green when at a certain angle to the light. In a very similar species, the Australian Emerald *H. australiae*, mature adults have emerald green eyes as well as the sheen on the abdomen (Brisbane insects web site).

Australian Emperors and Tau Emeralds spend most of their time on the wing. Tau Emeralds often hover in the same place for a few seconds—a feature that, along with their smaller size, distinguishes them from Australian Emperors. By contrast, male Blue Skimmers and Wandering Perchers perch frequently while guarding their territories. Generally they choose vegetation close to the water (Figs. 3 and 6), but both species often land on light-coloured objects such as dead leaves, or white areas on coloured cardboard, and Blue Skimmers sometimes alight

on white spots of bird dung (Fig. 5), rocks and other objects (pers. obs.).

Blue Skimmers and Tau Emeralds mate for only a short time, after which the pairs separate and the females lay their eggs alone (Brisbane insects web site). Some pairs of Blue Skimmers I observed (Fig. 4) mated for about 90 seconds rather than 2-4 seconds as stated on the Brisbane insects web site. The Tau Emeralds mated for several minutes, half hidden in vegetation such as bulrushes *Typha* sp. or shrubs. I missed seeing the females of both species lay their eggs because I lost sight of them soon after they flew away.

Wandering Perchers remain in tandem after mating. They fly low over the water, and the female frequently dips the end of her abdomen in, 'washing' off her eggs (Brisbane insects web site; Ian Endersby pers. comm. 18 February 2011). At the basin, hungry hordes of the introduced Mosquitofish *Gambusia* sp., a major pest in Australia (Australian Museum web site), gathered around and followed the laying females, devouring the eggs as they were laid (pers. obs.). Despite their name, Mosquitofish do not eat many mosquito larvae (Australian Museum web site), but they attack and kill dragonfly larvae (Calam Vale Creek web site).

Dragonflies, on the other hand, are considered beneficial insects because they do eat mosquitoes (Zborowski and Storey 2003): the larvae eat mosquito larvae, and the adults eat adult mosquitoes (Mosquito world web site) as well as other types of insects. Dragonflies' and damselflies' big eyes have almost 360° vision, excellent for detecting prey.

Damselflies

I was thrilled to find six beautiful damselfly species at the basin: Blue Ringtail *Austrolestes annulosus* (Lestidae) (Fig. 8), Wandering Ringtail *Austrolestes leda* (Lestidae) (Fig. 9), Red and Blue Damsel *Xanthagrion erythroneurum* (Coenagrionidae) (Fig. 10), Eastern Billabongfly *Austroagrion watsoni* (Coenagrionidae), Aurora Bluetail *Ischnura aurora* (Coenagrionidae) (Fig. 11) and Common Bluetail *Ischnura heterosticta* (Coenagrionidae) (front cover, back cover). These insects spent much of their time in the vegetation near the water but, because of their small size, delicate structure, infrequent movements and wary nature, they were not as easy to observe as their more conspicuous cousins.

Male Blue Ringtails and Wandering Ringtails remain with the female during egg-laying (Esperance wildlife web site—Blue Ringtail (photos); Brisbane insects web site—Wandering Ringtail), but during my brief sightings I saw none of this behaviour. Red and Blue Damsels mated in the grass, then flew over the water where the male remained in tandem with the female while she laid her eggs in the eelweed. This was the only species of damselfly I managed to see laying eggs. I found a pair of Eastern Billabongflies mating, but unfortunately I disturbed them and they quickly disappeared from view after flying away in the 'wheel position'. Common Bluetails were visible on numerous occasions, but I didn't see the sexes interact. I discovered one female



Fig. 8. Male Blue Ringtail



Fig. 9. Male Wandering Ringtail



Fig. 10. Male Red and Blue Damselfly

eating another damselfly (possibly an Aurora Bluetail), one eating a fly, and two in egg-laying posture — one on a blade of grass, and the other on a dry plant stem.

Conclusion

The recent wet summer has been favourable for the Odonata, and many people have commented on the abundance of dragonflies. I have been fortunate to experience the excitement of watching just ten of Australia's 324 species of these fascinating insects close to where I live. It will be interesting to note how the populations at the basin fare next year, because Mosquitofish, which are very prolific breeders, are already present in huge numbers.

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References

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Fig. 11. Male Aurora Bluetail

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